U. S. Department of Agriculture,

FORESTRY DIVISION.

INFORMATION TO WOOD CONSUMERS.

Increasing the Durability of Timber.

Our people waste a large amount of timber and of labor, by lack of care for the timber, after it is cut. Rotting of timbers and fence posts necessitate not only the cutting of a larger quantity of wood but also the labor of replacing the same oftener, than if the wood could be made to last longer.

There are some rules in the handling of timber, which are too often overlooked and which should be observed by everybody, who uses wood in places where it cannot be kept dry or wholly submerged.

There is also much unintelligent use of paints and other coatings, applied in the hope of preserving timber, when it should have been well known, that by painting green or badly seasoned timber, decay is hastened rather than prevented.

While to many it may be impossible to apply the more complicated and expensive methods of wood preservation which recommend themselves to large consumers of wood material, knowledge of the following considerations, suggested by the Chief of the Forestry Division, will aid the small consumer to handle his material to better advantage, to utilize forest products more thoroughly and intelligently, and to make them last from two to three times as long as when not observed.

DECAY OF WOOD.

1. Decay of wood is due to fermentation of the sap, induced probably by the growth of either bacteria or fungi. These organisms need for their development warmth and moisture, besides the nitrogenous substances and salts contained in solution in the sap.

To *prevent* the growth of these ferments, therefore, the sap in the wood must be dissolved (leached) or dried out, and moisture be prevented from entering again.

THE MANNER OF USE INFLUENCES DURABILITY OF TIMBER.

2. Timber placed entirely under water or deep in soil (drain pipes) will practically not decay, nor is it liable to rot, when kept absolutely dry, away from the influence of humid atmosphere.

Wood generlly decays in proportion to the warmth of the temperature. Hence on northern exposures, in cool valleys, on high elevations in northern countries, the duration of wood is longer than when placed under opposite influences.

If wood is used in contact with the the ground, decay proceeds the more rapidly, (beginning at the point of contact with the soil) the looser, moister, and warmer the soil, and especially the greater the liability of change from dry to wet; therefore timber will last longer in heavy, always moist clay, than in loose, alternately moist and dry sand or gravel, or in warm, comparatively dry lime soils.

Rooms without ventilation induce decay, producing the dry-rot, (which first appears in white patches changing into brown or gray). Ventilation, drying-out, and isolation from moisture will cure this defect.

NATURAL FACTORS INFLUENCING DURABILITY.

3. Sound mature trees yield more durable timber than either young or very old trees. Maturity is the time when trees have ceased to grow vigorously, which is indicated by a flattening of the crown, dying-out of branches in the crown, and by the change of color of the bark. Maturity may be reached, according to circumstances, by the same species, when the diameter is only a few inches or when it is as many feet. The small tree on arid soil or overtopped by others from its birth, may be as old and older than a tree of greater dimensions growing under more favorable conditions. Of two pieces *of the same kind* the heavier is the more durable, although absolute weight of two different kinds of timber, does not determine their relative durability.

Heart-wood, as a rule, can resist deterioration longer than sap-wood, because it contains less sap; but, when the sap-wood is well seasoned and heavier, this difference disappears.

The site has an influence on durability in so far as it influences the formation of heavy wood.

Quickly-grown hard-woods with wide annual rings, and *slowly-grown conifers* with narrow (yet not too narrow) rings, and "tapped" pines (on the tapped side) yield, as a rule, the most durable wood, other conditions being equal.

Coniferous wood from comparatively poor soils, high altitude, and dense forest, hard-woods from rich deep warm soils and isolated position, are most durable.

The resinous substances in conifers form an element of protection against decay.

4. The following list of trees comprises most of those of common occurrence which have been found to be the most durable. Without means of determining the exact relative value of the different species, it has been possible only to give a series which in general proceeds from the most durable to less durable ones.

EASTERN RANGE.

Conifers: Red Cedar, *Juniperus Virginiana, L.*; White Cedar, *Chamaecyparis sphæroidea*, Spach.; Arbor-Vitae, *Thuya occidentalis, L.*; Bald Cypress, *Taxodium distichum*, Rich.; Long-leaved Pine, *Pinus palustris*, Miller; Red Pine, *Pinus resinosa*, Ait.; Cuban Pine, *Pinus Cubensis*, Griseb.; Short-leaved Pine, *Pinus mitis*. Michx.

Broad-leaved Trees: White Oak, *Quercus alba*, L.; Post Oak, *Quercus obtusiloba*, Michx.; Basket Oak, *Quercus Michauxii*, Nutt.; Burr Oak, *Quercus macrocarpa*, Miehx.; Chestnut Oak, *Quercus prinus*, L.; Live Oak, *Quercus virens*, Ait.; Osage Orange, *Maclura aurantiaca*, Nutt.; Hardy Catalpa, *Catalpa speciosa*, Warder; Black Locust, *Robinia pseudacacia*, L.; Honey Locust, *Gleditschia triacanthos*, L.; Red Mulberry, *Morus rubra*, L.; Chestnut, *Castanea vulgaris*, var. *Americana*, A. D C.

ROCKY MOUNTAIN REGION.

Red Cedar, *Juniperus Virginiana*, L.; Pinyon Pine, *Pinus edulis*, Engelm.; Fox-tail Pine, *Pinus Balfouriana*, Murray; Douglas Spruce, *Pseudotsuga Douglasii*, Carr.; Western Larch, *Larix occidentalis*, Nutt.; Burr Oak, *Quercus macrocarpa*, Michx.

PACIFIC SLOPE.

Yew, *Taxus brevifolia*, Nutt.; Redwood, *Sequoia sempervirens*, Endlicher; Lawson's Cypress, *Chamaecyparis Lawsoniana*, Parl.; Canoe Cedar, *Thuya gigantea*, Nutt.; Douglas Spruce, *Pseudotsuga Douglasii*, Carr.; Western Larch, *Larix occidentalis*, Nutt.; Live Oak, *Quercus chrysolepis*, Liebm.; Post Oak, *Quercus Garryana*, Dougl.

TIME OF FELLING.

5. With proper after-treatment of the wood the time of felling seems not to affect its durability. Early winter felling (December) should have the preference, because less fermentable sap is then in the trees, and the timber will season with less care, more slowly and more evenly, and before the temperature is warm enough for fermentation to set in.

If the wood is cut "in the sap" it is more liable to fermentation and to the attacks of insects, and more care is necessary in seasoning; for the rapid seasoning, due to the warm dry atmosphere, produces an outer seasoned coat which envelopes an unseasoned interior liable to decay. When cut in the leaf it is advantageous to let the trees lie full length until the leaves are thoroughly withered (2 or 3 weeks), before cutting to size. With conifers this is good practice at any season, and if it can be done, all winter-felled trees should be left lying to leaf out in spring, by which most of the sap is worked out and evaporated.

TREATMENT AFTER FELLING.

6. Always remove the bark from felled timber to aid seasoning—but *not* from the standing tree.

Never allow the log to lie directly on the moist soil.

If winter-felled, shape the timber to size within two weeks after felling and leave it placed on blocks—not upon the soil—in the forest, or if shaped at home place in a dry, *airy*—not windy—position away from sun and rain.

If dried too rapidly, wood warps and splits, the cracks collect water and the timber is then easily attacked and destroyed by rot.

With large logs, checking may be prevented by coating the ends with some fatty or oily substance mixed with brick dust, or covering with a piece of linen, cloth, or even paper, or by simply shading them to lessen evaporation; cracks on the sides may be filled in with tow or cotton.

When piling timber, place laths or sticks of uniform size at uniform distances under each log, or post, or tie.

Sufficiently thorough seasoning for most purposes is obtained in 12 to 18 months, while for special work, according to the size, from 2 to 10 years is required.

The best method of obtaining proper seasoning without costly apparatus in shorter time, is to *immerse the prepared timber in water*, from one to three weeks, to dissolve the fermentable matter nearest the surface. This is best done in running water—if such is not at hand, a bath may be substituted, the water of which needs frequent change. Timber so treated, like raft-timber, will season more quickly and is known to be more durable.

If practicable the application of boiling water or steam is an advantage in leeching out the sap.

COATINGS TO KEEP OUT MOISTURE.

7. Never apply paint or any other coating to green or unseasoned timber. If the wood was not well dried or seasoned, the coat will only hasten decay.

Good coatings consist of oily or resinous substances which make a smooth coat, capable of being uniformly applied; they must cover every part, must not crack, and possess a certain amount of plasticity after drying.

Coal-tar, with or without sand or plaster or pitch, especially if mixed with oil of turpentine and applied hot, (thus penetrating more deeply) answers best. A mixture of 3 parts coal-tar and one part clean unsalted grease, to prevent the tar from drying until it has had time to fill the minute pores, is recommended. One barrel of coal-tar ($3. to $4. per barrel) will cover 300 posts. Wood-tar is not serviceable because it does not dry.

Oil paints are next in value. Boiled linseed oil or any other drying vegetable—not animal—oils, are used with lead or any other body [like pulverized charcoal] to give substance. Immersion in crude petroleum is also recommended.

Charring of those parts which come into contact with the ground can be considered only as an imperfect preservative, unless a considerable layer of charcoal is formed, and if it is not carefully done, the effect is often detrimental, as the process both weakens the timber and produces cracks, thus exposing the interior to ferments.

Lastly, in communities where durable timber is scarce it will pay to establish a plant for impregnating timber with antiseptics by the more costly processes described in Forestry Bulletin No. 1.

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Commissioner of Agriculture.